

Applicant: Katsumi Sameshima
Serial No.: 09/451,979
Filing Date: November 30, 1999
Group Art Unit: 2814
Examiner: Wai Sing Louie
Page 4

REMARKS

The last Office Action in the above-identified application, which has been made final, and the references cited by the Examiner have been carefully considered. Claim 4 has been amended in a sincere effort to define more clearly and more specifically features of Applicant's invention which distinguish over the art of record.

Claim 1 has been rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,708,284 (Onishi) in view of U.S. Patent No. 4,737,422 (Knight et al.). The Examiner contends that the Onishi patent discloses an insulation film 7 having a concave portion at a top surface, a laminated body obtained by laminating a plurality of layers on the top surface and etching a region of the plurality of layers corresponding to a region other than the concave portion, where the laminated body includes a lower electrode 8 which is brought into contact with a bottom surface of the concave portion, a ferroelectric layer 9 formed on the lower electrode 8 and an upper electrode layer 10 formed on the ferroelectric layer 9, where a portion of the lower electrode layer 8 protrudes outward from an inner peripheral edge forming the concave portion, and a side of a portion of the lower electrode layer 8, a side of the ferroelectric layer 9, and a side of the upper electrode layer 10 are flush with each other (the Examiner refers to Figure 6 of the Onishi patent for showing this structure), and a film 8a formed in a bottom of the hollow and separating between the insulating film 7 and the lower electrode layer 8b (the Examiner again refers to Figure 6 of the Onishi patent for showing this structure).

The Examiner acknowledges that the Onishi patent does not disclose that the lower electrode layer is made of a gel dry film, which limitation was added in the amendment filed on August 21, 2003. However, the Examiner contends that the Knight, et al. patent discloses forming the lower electrode by vacuum drying a gel solution, and refers to Column 14, lines 57-68 in the Knight, et al. patent for disclosing this feature. The Examiner further contends that the Knight et al. patent teaches that the gel method could control the physical form and the degree of polymerization of the electrode, at Column 15, lines 13-15, and, therefore, it would have been obvious to modify the Onishi device with the teaching of Knight, et al. to

Applicant: Katsumi Sameshima
Serial No.: 09/451,979
Filing Date: November 30, 1999
Group Art Unit: 2814
Examiner: Wai Sing Louie
Page 5

use the gel method to form the lower electrode in order to control the physical form and the degree of polymerization.

Claim 3 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over the Onishi patent modified by the Knight, et al. patent as applied to Claim 1, and further in view of U.S. Patent No. 5,861,344 (Roberts, et al.). The Examiner, basically, states that the Onishi patent discloses the structure mentioned previously with respect to Claim 1, but acknowledges that the Onishi patent fails to disclose that the first electrode portion 8a is formed only at a corner of the hollow. The Examiner, however, contends that the Roberts, et al. patent discloses forming an improved electrical contact by depositing the corner fill 32 in the hollow, and refers to Column 7, lines 19-30 and Figures 3 and 4 of the Roberts, et al. patent for disclosing this. The Examiner further contends that the Roberts, et al. patent discloses that the first electrode portion acts as seeding material and selective deposit at the corner, and refers to Column 2, lines 41-44 of the Roberts, et al. patent for disclosing this, and further contends that the Roberts, et al. patent teaches that this improves metal contact in the hollow, at Column 7, lines 19-23 thereof. The Examiner concludes, therefore, that it would have been obvious for one with ordinary skill in the art to modify the Onishi structure in accordance with the teachings of the Roberts, et al. patent to provide the corner fill in the hollow in order to establish the seeding material and improve metal contact in the hollow.

Claim 4 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over the Onishi patent modified by the Knight, et al. patent as applied to Claim 1, and further in view of U.S. Patent No. 6,344,413 (Zurcher, et al.). The Examiner acknowledges that the Onishi patent does not disclose that the lower electrode is formed on a surface of a thin film of the same material as that of the lower electrode. However, the Examiner contends that the Zurcher, et al. patent discloses a thin film of titanium which may be deposited on top of the first conductive layer 208, and refers to Column 6, lines 28-43 of the Zurcher, et al. patent for disclosing this structure. The Examiner further contends that the Zurcher, et al. patent discloses that the thin film serves as an adhesion layer, at Column 6, lines 28-43. The Examiner concludes, therefore, that it would have been obvious for one with ordinary skill in the art to modify the Onishi structure in accordance with the teaching of the Zurcher, et al.

Applicant: Katsumi Sameshima
Serial No.: 09/451,979
Filing Date: November 30, 1999
Group Art Unit: 2814
Examiner: Wai Sing Louie
Page 6

patent to provide a thin film in the lower electrode in order to approve the adhesion to the lower electrode, and further contends that the first conductive layer 208 is made of titanium, which is the same material as the thin film.

Claim 5 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over the Onishi patent modified by the Knight, et al. patent as applied to Claim 1, and further in view of U.S. Patent No. 5,767,541 (Hanagasaki). With respect to Claim 5, the Examiner acknowledges that the Onishi patent does not disclose that the top surfaces of the lower electrode and the insulating film are planarized flush with each other. However, the Examiner contends that the Hanagasaki patent discloses a lower electrode which is planarized flush with the insulating film, and refers to Figure 1E of the Hanagasaki patent for showing this. The Examiner further contends that the Hanagasaki patent discloses that planarization could remove surface irregularities, and refers to Column 7, line 37 of the Hanagasaki patent for disclosing this. The Examiner concludes, therefore, that it would have been obvious for one with ordinary skill in the art to modify the Onishi structure with the teaching of the Hanagasaki patent to planarize the top surface of the lower electrode flush with the insulating film in order to remove the surface irregularities.

The courtesy of Examiner Wai-Sing Louie in permitting a telephonic interview with the undersigned attorney concerning this application is acknowledged and gratefully appreciated. The interview occurred on April 8, 2004, between the undersigned attorney, Gerald Bodner, and Examiner Louie.

During the interview, the undersigned attorney explained the differences between the structure set forth in the claims pending in the application and the references which Examiner Louie cited. In particular, the undersigned attorney pointed out that U.S. Patent No. 4,737,422 (Knight, et al.), which was the new patent cited by Examiner Louie, was incorrectly cited as showing the formation of the lower electrode by a sol gel technique or for showing that the lower electrode is made of a gel dry film. The undersigned attorney pointed out that the Knight et al. reference actually shows the dielectric or ferroelectric layer being formed by a gel method.

Applicant: Katsumi Sameshima
Serial No.: 09/451,979
Filing Date: November 30, 1999
Group Art Unit: 2814
Examiner: Wai Sing Louie
Page 7

After the undersigned attorney discussed the Knight, et al. patent, Examiner Louie stated: "You have my attention", especially in view of Claim 1. Examiner Louie said to the undersigned attorney that if he did not cite the references properly to meet the claim limitations, then he must either allow the case or withdraw the final rejection and issue a new, non-final rejection.

Examiner Louie asked the undersigned attorney to file a response to the final Office Action in which Applicant points out the differences between the cited references and the structure set forth in the pending claims to him again. Examiner Louie advised the undersigned attorney that he was mostly concerned with his misapplying the Knight, et al. patent, and that he will look at Applicant's arguments concerning all of the references again.

Applicant has carefully analyzed the claims pending in the application (that is, Claims 1, 3, 4 and 5), and the structure of the semiconductor devices shown in the Onishi patent, the Knight, et al. patent, the Roberts, et al. patent, the Zurcher, et al. patent and the Hanagasaki patent. Furthermore, a minor amendment has been made to Claim 4 for the Examiner's consideration, as will be discussed herein in greater detail. It is respectfully urged that these references, alone or in combination, do not teach or suggest the structure of the semiconductor device set forth in the claims pending in the application.

With respect to Claim 1, the undersigned attorney pointed out to Examiner Louie during the interview that the claim calls for the lower electrode being made of a gel dry film. The undersigned attorney further explained to Examiner Louie that Examiner Louie agreed in the Office Action that the Onishi patent does not disclose this, but that he cited the Knight, et al. patent for showing the lower electrode formed by vacuum drying a gel solution.

The undersigned attorney pointed out to Examiner Louie that the Knight et al. patent discloses, at Column 14, lines 57-68, that the dielectric, not the lower electrode, is formed by a gel method. The undersigned attorney explained that with the sol gel technique, the precursor which forms the gel dry film is splashed away by centrifugal force, but the precursor in the hole is not splashed away and it remains in the hole. Thus, neither the Onishi patent nor the Knight, et al. patent teaches using a sol gel method to form an electrode within